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(54) [Title] Absorbent Article and Method of Manufacturing Same

Abstract

Objective

To produce an absorbent article having outstanding stability in product performance in which the problem of elongation of the elastic body at the time of fabrication is solved and to provide a method for manufacturing the aforementioned absorbent article at a high rate of production.

Constitution

An absorbing article characterized by the fact that a sheet-like material having a copolymer as an essential resin component that internally contains two or more crystalline components, which material can be obtained by heating and drawing a rubber copolymer at a temperature lower than the melting point of same followed by cooling, and in which stretchability is imparted by heating, is fixed as an elastic body at a required position of the absorbent article, and a method for manufacturing the absorbing article consisting of heating after fixing the aforementioned sheet-like material at a desirable position of the absorbing article to impart stretchability to the required position.

Claims

1. An absorbing article characterized by the fact that a sheet-like material having a copolymer as an essential resin component that internally contains two or more crystalline components, which material can be obtained by heating and drawing a rubber copolymer at a temperature lower than the melting point of same followed by cooling, and in which stretchability is imparted by heating, is affixed as an elastic body to a required position of the absorbent article.
2. The absorbing article described in Claim 1 characterized by the fact that the aforementioned sheet-like material includes at least 30 wt% of an elastomer of ethylene and an α -olefin as essential resin components and having crystallinity and is uniaxially drawn by a factor of at least 1.5, undergoes contraction to at least 40% upon heating, and has stretchability in at least the drawing direction at normal temperatures after contraction.
3. The absorbing article described in Claim 2 characterized by the fact that the aforementioned elastomer is a terpolymer comprised of ethylene, 1-butene and a non-conjugated diene and that the amount of ethylene included is at least 80 wt%.
4. A method for manufacturing an absorbing article consisting of heating after fixing a sheet-like material having a copolymer as an essential resin component that internally contains two or more crystalline components, which material can be obtained by heating and drawing a rubber copolymer at a temperature lower than the melting point of same followed by cooling, onto a desirable position of the absorbing article to impart stretchability to a required position.

Detailed explanation of the invention

[0001]

Industrial application field

The present invention pertains to an absorbing article mainly used for disposable diapers, etc., and to a method for manufacturing same.

[0002]

Prior art and problems to be solved by the invention

In general, an elastic body is incorporated in an absorbing article. In many cases, the aforementioned elastic body is incorporated into an absorbing article in the production line while being stretched, but when the aforementioned elastic body is incorporated in an extended state, variations occur in the extension factor. As a result, the properties of the elastic body region vary and the stability of the product performance is inferior.

[0003]

Furthermore, when the elastic body is incorporated into an absorbing article under the aforementioned conditions, the equipment used for production is complicated, and furthermore, the elastic body is incorporated on the production line in an extended state, and the production speed is reduced.

[0004]

In an effort to eliminate the aforementioned existing problems, the technologies disclosed in Japanese Kokoku Patent No. Hei 4[1992]-64701, Japanese Kokai Patent Application No. Sho 59[1984]-144601, Japanese Kokai Patent Application No. Sho 60[1985]-17101, Japanese Kokai Patent Application No. Sho 60[1985]-250935, Japanese Kokai Patent Application No. Sho 63[1988]-112714, Japanese Tokuhyo Patent Application No. Sho 64[1989]-500361, etc., are known.

[0005]

In the technology disclosed in the aforementioned Japanese Kokoku Patent No. Hei 4[1992]-64701, the extensible material is stretched in a line at a high temperature; then, it is cooled to normal temperature and incorporated into the product, but the method is accompanied by problems such as variation in stretchability and reduction in stretchability, and is not suitable for high-speed production.

[0006]

Furthermore, the technology disclosed in the aforementioned Japanese Kokai Patent Application No. Sho 59[1984]-144601 is to produce a disposable diaper having a waist band made of an elastic material with high extensibility. The elastic material is stretched during assembly of the elastic material while under tension at the time of fabrication, and the method is accompanied by problems disclosed in Japanese Kokoku Patent No. Hei 4[1992]-64701.

[0007]

Furthermore, in the technology disclosed in the aforementioned Japanese Kokai Patent Application No. Sho 60[1985]-17101, an EVA rubber elastomer blended with an EP rubber is used for the elastic body and fastening is done while stretching the aforementioned elastic body.

[0008]

Furthermore, in the technology disclosed in the aforementioned Japanese Kokai Patent Application No. Sho 60[1985]-250935, an elastomer made of a block copolymer consisting of a repeating unit of polyamide and polyether is used as the elastic body.

[0009]

And furthermore, in the technology disclosed in the aforementioned Japanese Kokai Patent Application No. Sho 63[1988]-112714, a strong reinforcing body is bonded to fix the material and then a mechanical treatment is applied for elastic shearing, but in general, when the strength of the aforementioned reinforcing body is too high, the stretching ratio is reduced after contraction. In specific terms, problems such as high permanent set and high hysteresis can be mentioned. Furthermore, when the elastic body is mechanically fixed onto a substrate, problems such as elongation of the material at the time of fixing and reduced high-speed productivity due to fixing to a belt exist.

[0010]

And finally, in the technology disclosed in the aforementioned Japanese Tokuhyo Patent Application No. Sho 64[1989]-500361, an elastomer that remains non-elastic at a time of non-contraction but becomes elastic at a time of contraction is used and heat shrinkage is provided after incorporating the aforementioned elastomer into the disposable diaper to provide the elastic area, but a description of the specific material composition and properties of the material is not provided.

[0011]

Thus, the aforementioned technologies of the prior art do not solve problems that occur during fabrication of the elastic material and during elongation at the time of incorporation of the material at the time of manufacture of the absorbing article and furthermore, they do not meet the desire for high speed production.

[0012]

Based on the above background, the objective of the present invention is to produce an absorbent article having excellent stability in terms of product performance in which problems caused by elongation of an elastic body at the time of fabrication are solved and to provide a method for manufacturing the aforementioned absorbent article at a high rate of production.

[0013]

Means to solve the problems

As a result of much research conducted by the inventors of the present application in an effort to eliminate the aforementioned existing problems, the inventors discovered that the aforementioned objective could be achieved by an absorbing article that utilizes a sheet-like material obtained by drawing a material mainly comprising an elastomer having crystallinity as an elastic body, and as a result, the present invention was accomplished.

[0014]

Thus, the objective of the present invention is to produce an absorbing article characterized by the fact that a sheet-like material having a copolymer internally containing two or more crystalline components, which material can be obtained by heating and drawing a rubber copolymer, as an essential resin component, at a temperature lower than the melting point of same followed by cooling and in which stretchability is imparted by heating, is fixed as an elastic body at a required position of an absorbent article.

[0015]

Furthermore, the objective of the present invention is to provide a method for manufacturing an absorbing article consisting of heating after fixing a sheet-like material having a copolymer as an essential resin component that internally contains two or more crystalline components, which material can be obtained by heating and drawing a rubber copolymer at a temperature lower than the melting point of same followed by cooling, at a desirable position of the absorbing article to impart stretchability at a required position.

[0016]

The absorbing article of the present invention will be explained in further detail below. The absorbing article of the present invention is characterized by the fact that a specific sheet-like material is fastened as an elastic body to a required position of the absorbing article. Disposable diapers, etc., can be mentioned as specific examples of the absorbing article of the present invention.

[0017]

The aforementioned specific sheet-like material used as an elastic body in the present invention is a sheet-like material having a copolymer as an essential resin component internally containing two or more crystalline components, which material can be obtained by heating and drawing a rubber copolymer at a temperature lower than the melting point of the same followed by cooling.

[0018]

The aforementioned rubber copolymer is not especially limited as long as a rubber copolymer internally having two or more crystalline components (components having two or more crystalline segments) is used, and for example, ethylene and α -olefin based elastomers having crystallinity can be mentioned. Furthermore, an elastomer obtained by copolymerizing the aforementioned elastomer with a diene as a third component can be used effectively as well. For the aforementioned diene, non-conjugating dienes such as dicyclopentadiene, methyl tetrahydroindene, methylene norbornene, ethylidene norbornene and 1,4-hexadiene can be used.

[0019]

Thus, for the crystalline components used in the aforementioned rubber copolymer, ethylene, α -olefins, etc., can be used effectively. Furthermore, it is desirable if the amount of the aforementioned crystalline components included is at least 80 wt% with respect to the entire rubber copolymer component, and furthermore, the aforementioned rubber copolymer may be composed of only the aforementioned crystalline components as well. The aforementioned crystalline components are polymer materials having a molecular orientation with some degree of order of which the crystalline structure can be clearly observed by X-ray analysis. In specific terms, polyethylenes having relatively simple monomers, polyacrylonitriles having strong polar groups, polyamides and polyesters that are likely to form hydrogen bonds between molecules, stereospecific polypropylenes and polystyrenes, celluloses and proteins that form natural fibers, etc., can be mentioned.

[0020]

Furthermore, the molecular weight of the aforementioned rubber copolymer used in this case is not especially limited, and $1-2 \times 10^5$ or higher is desirable. It is not desirable if the aforementioned molecular weight is $1-2 \times 10^5$ or lower since the stretchability is reduced sharply.

[0021]

In the aforementioned rubber copolymer, in order to provide sufficient crystallinity, an ethylene content of at least 80 wt% is desirable, and at least 90 wt% is further desirable.

[0022]

Furthermore, for the aforementioned α -olefin, propylene, 1-butene, 1-hexene, etc., can be mentioned, and in order to provide sufficient crystallinity, the amount included in the aforementioned rubber copolymer is not more than 30 wt%, preferably, not more than 20 wt%.

[0023]

Furthermore, it is desirable if the melting point of the aforementioned rubber copolymer is in the range of 60-120°C.

[0024]

The drawing temperature used for heating and drawing the aforementioned rubber copolymer is below the aforementioned rubber copolymer melting temperature, and a temperature in the range of 40-100°C is further desirable. Furthermore, the drawing ratio used in this case is preferably 1.5 or higher, and ideally 3 or higher, and it is desirable if an adjustment is made so that the obtained sheet-like material contracts when heated for 10-500 sec at a temperature in the range of 40-100°C, and a contraction rate of at least 40%, preferably, at least 50%, and furthermore, a permanent set of 20% or below, preferably, 10% or below can be achieved.

[0025]

Furthermore, for the aforementioned sheet-like material, a material that contains at least 30 wt% of the aforementioned ethylene and α -olefin based elastomer as the aforementioned resin component, that is uniaxially drawn by a factor of at least 1.5, that undergoes contraction to at least 40% upon heating, and that has stretchability at least in the drawing direction after the contraction and at normal temperature is desirable, and the aforementioned elastomer made of a terpolymer comprised of ethylene, 1-butene and a non-conjugated diene and with an ethylene content of at least 80 wt% is further desirable.

[0026]

The aforementioned sheet-like material may be composed of only the aforementioned essential resin components or a mixture with different resin components may be used. The amount of the essential resin components used when different resin components are used in combination, in general, is at least 30 wt%, preferably, at least 60 wt%, to maintain the nature of the resin components.

[0027]

For different resin components used in this case, thermoplastic resins having crystallinity, thermoplastic elastomers, and furthermore, other elastomers and mixtures of same can be mentioned.

[0028]

For the aforementioned thermoplastic resins having crystallinity, for example, a variety of high-density polyethylenes, medium-density polyethylenes, low density polyethylenes, linear low density polyethylenes, etc., can be mentioned, and furthermore, polypropylene singly and mixtures of the same can be used successfully.

[0029]

Furthermore, for the aforementioned thermoplastic elastomers, styrene-based (hard-phase: styrene, soft-phase: butylene rubber, isoprene rubber, hydrogenated butylene rubber), ester-based (hard-phase: polyester, soft-phase: polyether), urethane-based (hard-phase: urethane structure, soft-phase: polyester, polyether) ionomers can be mentioned. For other elastomers, natural rubbers, isoprene rubbers, butadiene rubbers, styrene butadiene rubbers, chloroprene rubbers, nitrile rubbers, butyl rubbers, acrylic rubbers, silicone rubbers, urethane rubbers, etc., can be mentioned.

[0030]

The aforementioned other resin components are added for adjustment of stretchability, stability of the elastic modulus, etc., and in this case, it is necessary to prevent loss of properties of the aforementioned essential resin components.

[0031]

The aforementioned sheet-like material can be used in a shape suitable for the intended application. In this case, shapes such as a film or filament can be mentioned, and the thickness of

the material is adjusted according to the intended application. And furthermore, foaming agents in order to reduce weight, fillers for an increase in heat conductivity, etc., may be included in the aforementioned sheet-like material, as desired.

[0032]

In the present invention, a material in which the soft segment of the aforementioned sheet-like material is partially crosslinked or slightly crosslinked before the drawing process can be used effectively. If partial crosslinking or slight crosslinking is provided, an increase in stretchability is achieved, and if the degree of crosslinking is too high, a reduction in crystallinity or a limitation in handling ease due to an increase in viscosity occurs. For the crosslinking method used in this case, sulfur crosslinking, peroxide crosslinking, electron beam crosslinking, etc., can be mentioned.

[0033]

The method for manufacturing the aforementioned absorbing article of the present invention is explained below. In the manufacturing method of the absorbing article of the present invention, the aforementioned sheet-like material is heated after fixing onto a required position of the absorbing article to achieve contraction and to provide stretchability at the required position.

[0034]

In the following, the method for the manufacturing absorbing product of the present invention will be explained. The method for manufacturing absorbing products of the present invention is characterized by the fact that after said sheet-like material is fixed at provide shrinkability at the desired position.

[0035]

The aforementioned required position varies depending on the type of absorbing article, and for example, in the case of a disposable diaper, it is the waist area, abdomen area and leg area.

[0036]

Upon fixing at the required position, bonding may be performed with an adhesive material, etc.

[0037]

Furthermore, the aforementioned heating is executed by applying sufficient energy for the aforementioned sheet-like material to undergo contraction but low enough to prevent crystal fusion of the sheet-like material. The type of energy used in this case is not especially limited as long as the external energy is capable of contracting the aforementioned sheet-like material, and for example, heat, infrared rays, electron rays, ultraviolet rays, etc., can be mentioned. Among those listed above, heating in an oven to utilize heat as energy is desirable from the standpoint of convenience, and in specific terms, it is desirable if heating is executed for 10-500 sec at a temperature in the range of 40-100°C.

[0038]

Application examples

The absorbent article and the method for manufacturing the aforementioned absorbent article of the present invention are explained in specific terms referencing Figures 1 and 2 and the present invention is explained in further detail with the application examples and comparative examples below, but the present invention is not limited by these examples.

[0039]

Figure 1 is a partial cut-away perspective view of a disposable diaper used as an example of the absorbent article of the present invention, and Figure 2 is a developed view of the inside of the disposable diaper shown in Figure 1 viewed from the top sheet side. In the disposable diaper 1 of the application example of the present invention shown in Figures 1 and 2, the aforementioned sheet-like material is fixed to the front and back waist members 5 and 5' and leg member 6 and abdominal area 8 as elastic bodies 10A, 10B, 10C and 10D.

[0040]

In specific terms, as shown in Figure 1, the disposable diaper 1 has a liquid-permeable top sheet 2, a liquid-impermeable back sheet 3, an absorbent article 4 placed between the aforementioned two sheets, and a fastening tape 7 for fastening the disposable diaper at the time of use. Furthermore, as shown in Figure 2, the aforementioned absorbent article 4 is formed with curves to have the shape of an hourglass with a narrow crotch area, and the crotch areas of the aforementioned top sheet 2 and back sheet 3 are curved to accommodate the shape of the aforementioned absorbent article 4, and the aforementioned absorbent article 4 is sandwiched between the top sheet 2 and back sheet 3 and fastened.

[0041]

For the aforementioned top sheet 2, the aforementioned back sheet 3, the aforementioned absorbent article 4 and the aforementioned fastening tape 7, those commonly used for this purpose can be used freely.

[0042]

Furthermore, the aforementioned sheet-like material is fixed to the front and back waist members 5 and 5' and leg member 6 and abdominal area 8 at the margins of the aforementioned absorbent article 4 as elastic bodies 10A, 10B, 10C and 10D to provide a good fit for the user at the front and back waist members 5 and 5' and leg member 6 and abdominal area 8.

[0043]

The aforementioned elastic body 10A is provided for the front and back waist members 5 and 5' to form gathers and the width and the length of the elastic body is not especially limited. It is desirable if the distance a from the aforementioned absorbent article 4 is at least 5 mm since, in this case, the stretchability of the aforementioned elastic body is not inhibited by the aforementioned absorbent article 4.

[0044]

The elastic body 10B is provided in such a manner as to form leg gathers and is provided for the leg members of both sides. The width and the length of the elastic body is not especially limited and it is desirable if the distance b from the aforementioned absorbent article 4 is at least 5 mm since, in this case, the stretchability of the aforementioned elastic body is not inhibited by the aforementioned absorbent article 4.

[0045]

Furthermore, the aforementioned elastic body 10C is provided to give a good fit for the user around the abdomen and 3 pieces each of an elastic body are provided for the front and back in such a manner that the disposable diaper undergoes stretching and shrinkage in the direction around the abdomen. The distance between the aforementioned elastic bodies 10C is preferably in the range of 1-50 mm, and in the range of 5-20 mm is further desirable. In this case, the number of aforementioned elastic bodies provided around the abdominal area is 3 each for the front and the back, but a desired number may be selected in the range of 2-20 pieces, preferably, 5-10. Furthermore, the width of the aforementioned elastic body 10C is preferably in the range of 0.1-10 mm and in the range of 2-5 mm is especially desirable. Obviously, the present invention is not limited by the numbers given above and the width and the distance between the

aforementioned elastic bodies may be the same as indicated or different. Furthermore, the number of elastic bodies and the distance between each of the elastic bodies may be the same or different in the front and in the back of the disposable diaper as well.

[0046]

And furthermore, the aforementioned elastic body 10D is provided near each edge of the absorbent article at the back side in order to provide a good fit around the back side. The size, etc., of the aforementioned elastic body 10D is not especially limited, and it is desirable if the aforementioned elastic bodies 10D are provided between the fastening tapes 7 provided in the horizontal direction.

[0047]

An example of a method for manufacturing the aforementioned disposable diaper 1 is explained in detail below. It should be noted that a standard manufacturing method can be freely used for items not explained in detail below.

[0048]

The absorbent article 4 and sheet-like material used as elastic bodies 10A, 10B, 10C and 10D are arranged on the inner surface of the aforementioned back sheet 3 at positions shown in Figure 1; then, the top sheet 2 is affixed to the back sheet 3. In this case, the aforementioned sheet-like material is affixed with an adhesive. Heating in an oven is then executed to provide extensibility to the aforementioned sheet-like material and thus to provide extensibility to the elastic bodies 10A, 10B, 10C and 10D and to provide the aforementioned disposable diaper 1.

[0049]

The present invention will be explained further in specific terms with the application examples and comparative examples below.

Application Example 1

An ethylene, 1-butene and ethylidene norbornene copolymer (molar ratio of the crystalline components ethylene/1-butene is 90/10, the weight ratio of the aforementioned crystalline components and ethylidene norbornene is 98:2) was drawn by a factor of 3 at a temperature of 45°C to form a sheet-like material having a thickness of 40 μm and a width of 25 mm. The stress at 10% distortion of the aforementioned sheet-like material was 200 g/25 mm width. The aforementioned sheet-like material was incorporated into the positions shown in Figure 1 and Figure 2; then, heat was applied for 30 sec in an oven heated to a temperature of

60°C to provide extensibility, and to give a disposable diaper provided with extensibility in the waist area. In this case, elongation of the aforementioned sheet-like material during the manufacturing process was absent. Furthermore, the shrinkage factor at this time was 55%. Furthermore, the stress at 50% distortion at the waist area of the obtained disposable diaper was 495 g/25 mm width and sufficient elasticity was exhibited for practical use.

[0050]

Application Example 2

A resin composition obtained by blending 80 wt% of an ethylene, 1-butene and ethylidene norbornene copolymer (molar ratio of the crystalline components ethylene/1-butene is 90/10, the weight ratio of the aforementioned crystalline components and ethylidene norbornene is 98:2), 10 wt% of a thermoplastic polyurethane elastomer and 10 wt% polyethylene was drawn by a factor of 3 at a temperature of 45°C to form a sheet-like material having a thickness of 40 µm and a width of 25 mm. The stress at 10% distortion of the aforementioned sheet-like material was 200 g/25 mm width. The aforementioned sheet-like material was incorporated into the positions shown in Figures 1 and 2. Then heat was applied for 30 sec in an oven heated to a temperature of 60°C to provide extensibility, and to give a disposable diaper provided with extensibility around the waist area. In this case, elongation of the aforementioned sheet-like material during the manufacturing process was absent. Furthermore, the shrinkage factor at the time was 48%. Furthermore, the stress at 50% distortion at the waist area of the obtained disposable diaper was 380 g/25 mm width and sufficient elasticity was exhibited for practical use.

[0051]

Application Example 3

A resin composition obtained by blending 80 wt% of an ethylene, 1-butene and ethylidene norbornene copolymer (molar ratio of the crystalline components ethylene/1-butene is 90/10, the weight ratio of the aforementioned crystalline components and ethylidene norbornene is 98:2) and 20 wt% of a styrene-butadiene block copolymer was drawn by a factor of 3 at a temperature of 45°C to form a sheet-like material having a thickness of 40 µm and a width of 25 mm. The stress at 10% distortion of the aforementioned sheet-like material was 200 g/25 mm width. The sheet-like material was incorporated at the positions shown in Figures 1 and 2. Then heat was applied for 30 sec in an oven heated to a temperature of 60°C to provide extensibility, and to give a disposable diaper provided with extensibility around the waist area. In this case, elongation of the aforementioned sheet-like material during the manufacturing process was absent. Furthermore, the shrinkage factor at this time was 41%. Furthermore, the stress at 50%

distortion at the waist area of the obtained disposable diaper was 445 g/25 mm width and sufficient elasticity was exhibited for practical use.

[0052]

Comparative Example 1

A resin composition obtained by blending 20 wt% of an ethylene, 1-butene and ethylidene norbornene copolymer (molar ratio of the crystalline components ethylene/1-butene is 90/10, the weight ratio of the aforementioned crystalline components and ethylidene norbornene is 98:2) and 80 wt% polyethylene was drawn by a factor of 3 at a temperature of 45°C to form a sheet-like material having a thickness of 40 µm and a width of 25 mm. The stress at 10% distortion of the aforementioned sheet-like material was 450 g/25 mm width and elongation of the aforementioned sheet-like material during the manufacturing process was absent. However, when the aforementioned sheet-like material was incorporated at the positions shown in Figures 1 and 2, and heat was applied for 30 sec in an oven heated to a temperature of 60°C to provide extensibility, the shrinkage factor was 20%, and sufficient elasticity was not achieved, and furthermore, the stress at 50% distortion at the waist area of the obtained disposable diaper was 800 g/25 mm width and in this case, sufficient elasticity was not achieved.

[0053]

Comparative Example 2

A resin composition obtained by blending 20 wt% of an ethylene, 1-butene and ethylidene norbornene copolymer (molar ratio of the crystalline components ethylene/1-butene is 90/10, the weight ratio of the aforementioned crystalline components and ethylidene norbornene is 98:2) and 80 wt% of a thermoplastic polyurethane elastomer was drawn by a factor of 3 at a temperature of 45°C to form a sheet-like material having a thickness of 40 µm and a width of 25 mm. The stress at 10% distortion of the aforementioned sheet-like material was 40 g/25 mm width, but elongation of the aforementioned sheet-like material during the manufacturing process was observed. And furthermore, when the sheet-like material was incorporated in the positions shown in Figures 1 and 2, and heat was applied for 30 sec in an oven heated to a temperature of 60°C to provide extensibility, the shrinkage factor was 25%, and sufficient elasticity was not achieved.

[0054]

Effect of the invention

According to the absorbent article of the present invention, an absorbent article having excellent stability in terms of product performance in which problems due to elongation of an

elastic body at the time of fabrication are solved, and furthermore, according to the method for manufacturing the aforementioned absorbent article of the present invention, it is possible to produce the aforementioned absorbent article at a high rate of production. In specific terms, in the method for manufacturing the absorbent article of the present invention, the sheet-like material is arranged at required positions. Then heat is applied to provide extensibility to the aforementioned sheet-like material to form an elastic body and elasticity is provided at required positions of the absorbent article. Therefore, stretching of the aforementioned sheet-like material is absent when tension is applied in the production line before heating and production of an absorbent article provided with sufficient elasticity for practical use at required positions can be achieved easily.

Brief description of the Figures

Figure 1 is a partial cut-away perspective view of a disposable diaper used as an example of the absorbent article of the present invention.

Figure 2 is a developed view of the inside of the disposable diaper shown in Figure 1 viewed from the top sheet side.

Explanation of symbols

1	Disposable diaper
2	Top sheet
3	Back sheet
4	Absorbent article
5	Front waist area
5'	Back waist area
6	Leg area
7	Fastening tape
10A, 10B, 10C and 10D	Elastic body

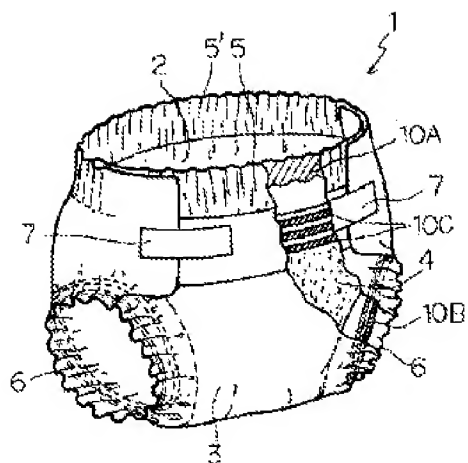


Figure 1

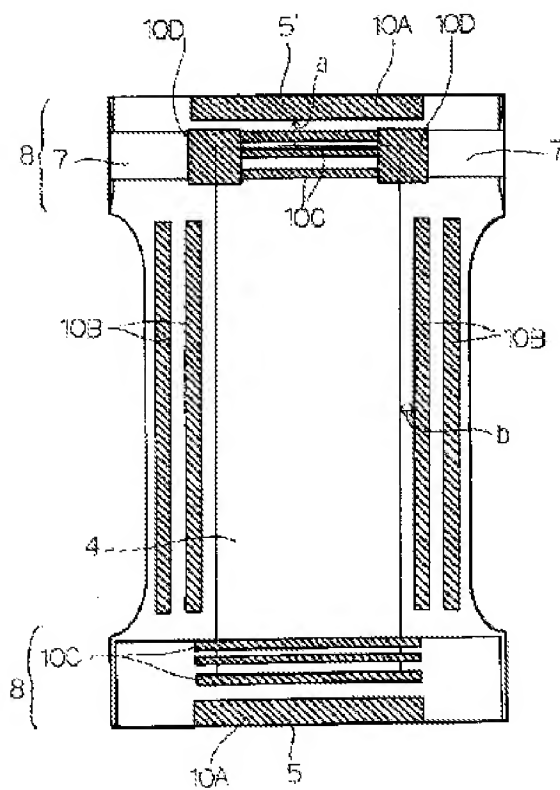


Figure 2